Inefficiency caused by Wire Center Supports in COT Tracking

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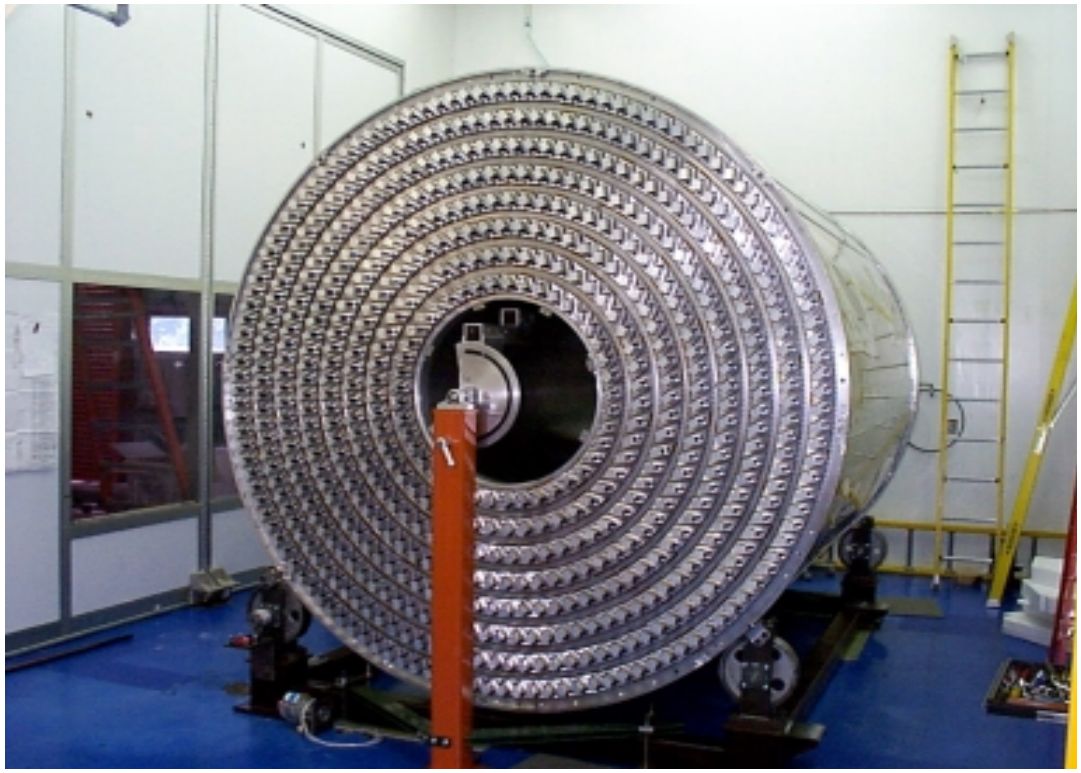
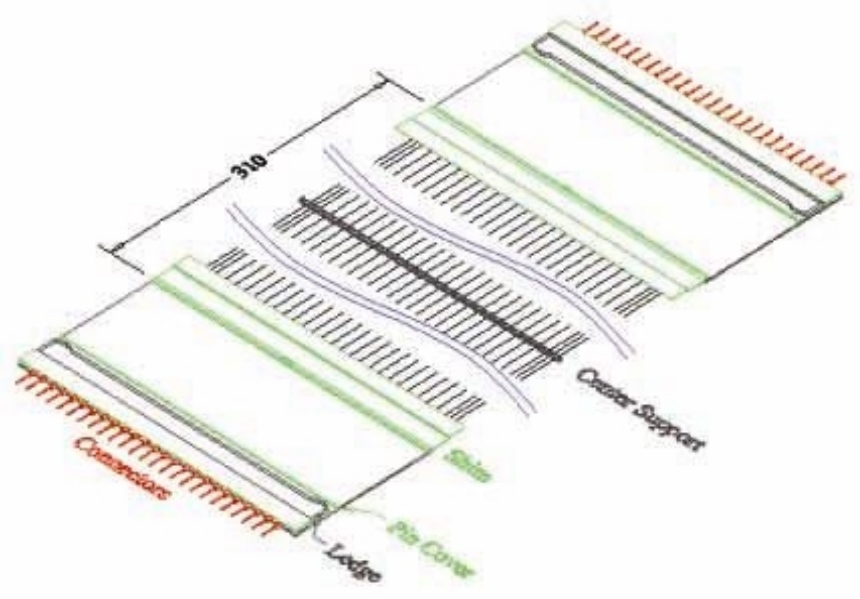
CDF COT



1. COT consists of 30,240 sense wires that runs the length in Z of the chamber between two end plates.
2. Half of the wires are axial and half are small angle stereo.

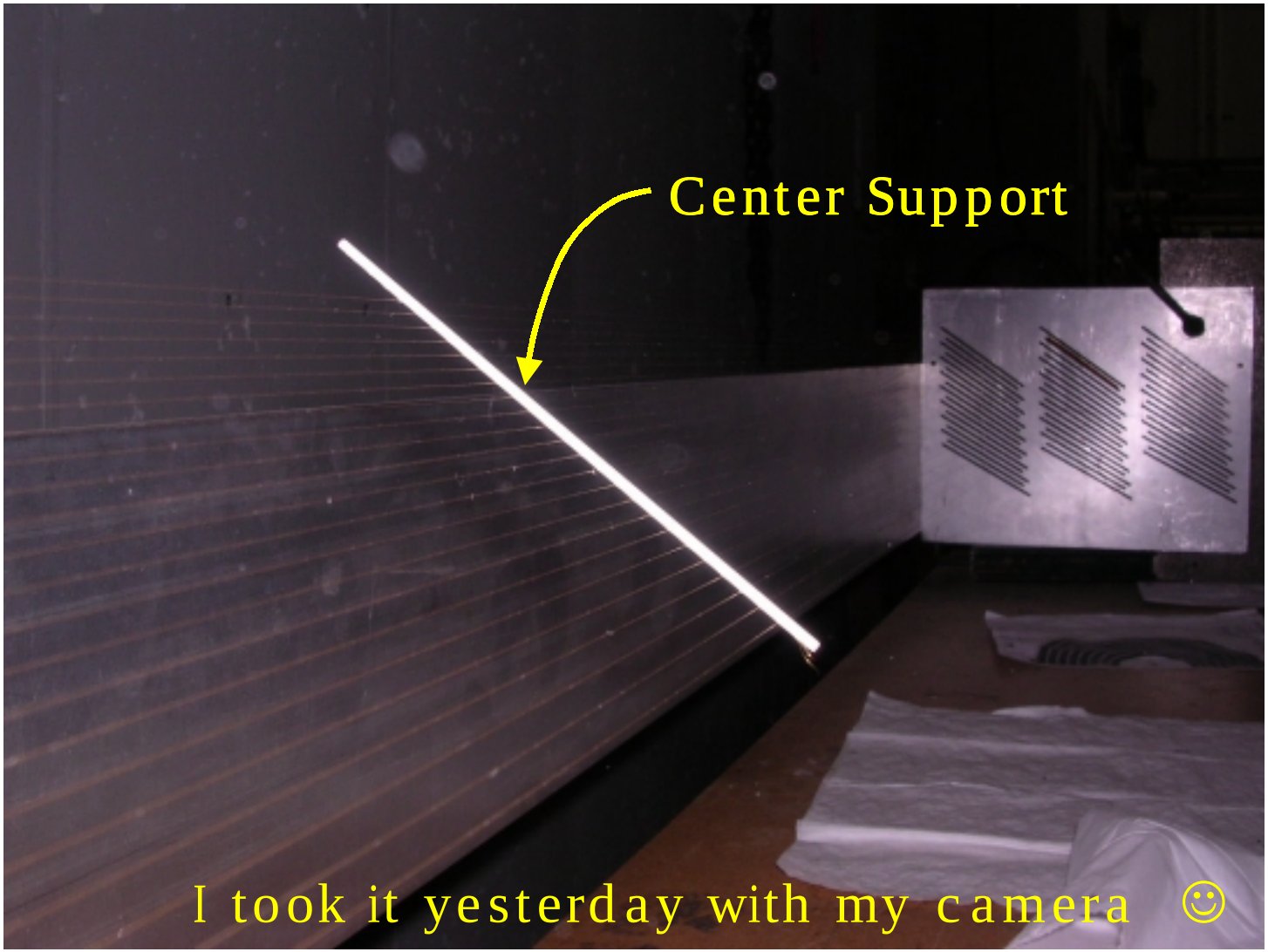
What is "Center Support"?



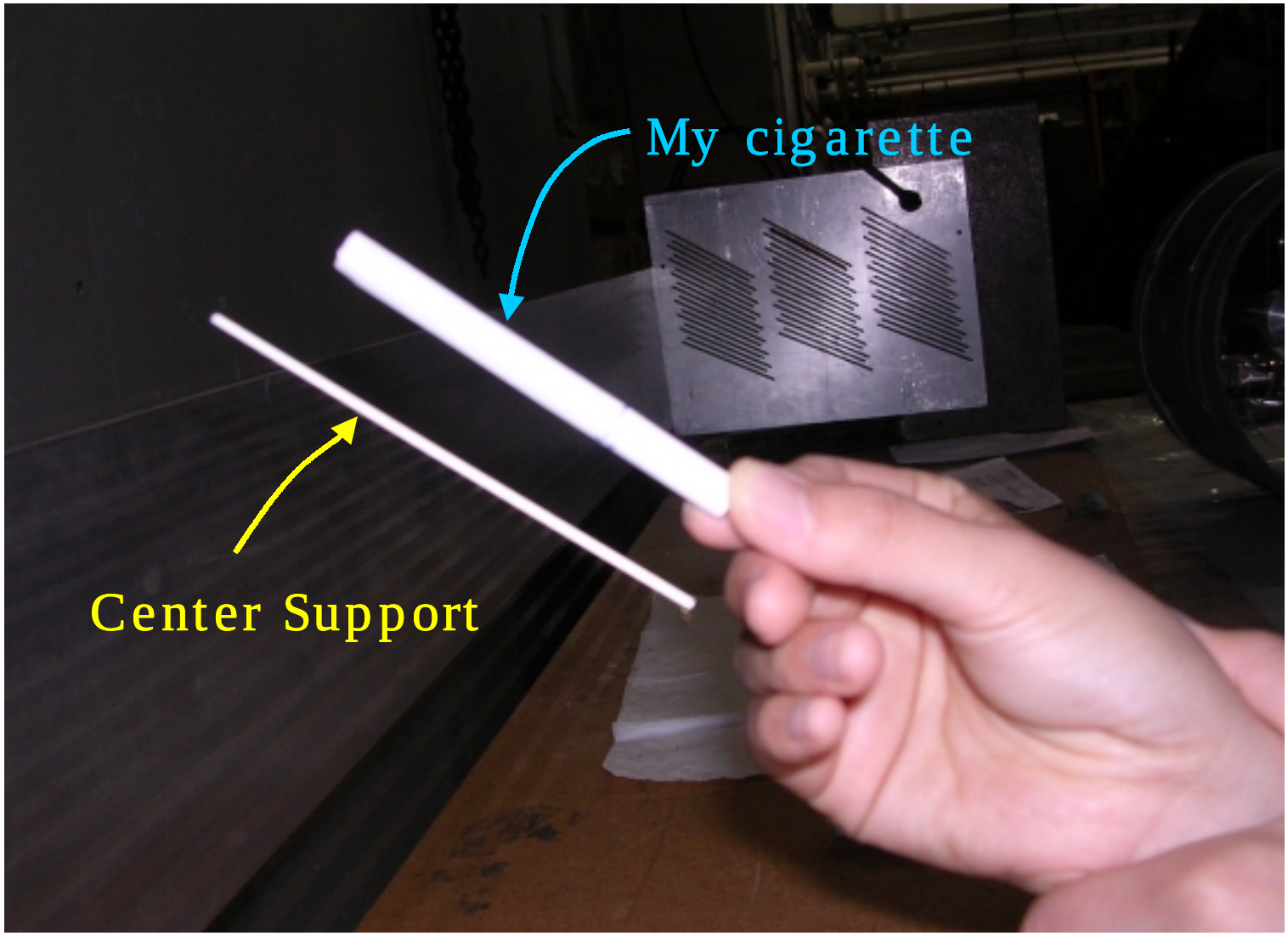
The center supports are made of round glass fiber pultrusion rods of 0.16 cm in diameter.

These are cut into 10 cm long and glued to th wire and cathode planes.

What is "Center Support"?



Size of "Center Support"



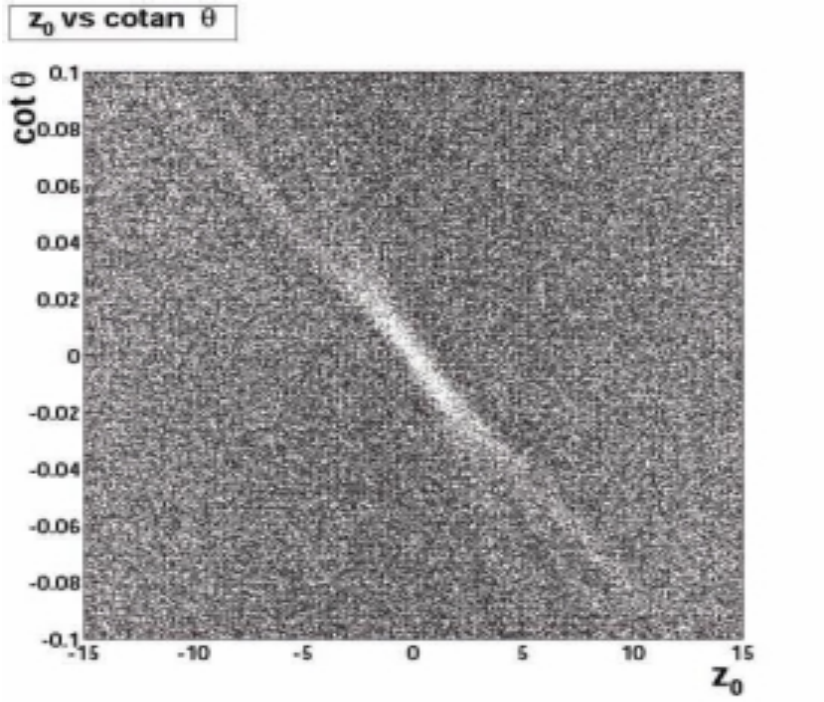
Effect of "Center Support"

The Center Supports reduce electric field locally and hence make pulse height smaller

→ This reads to lower hit efficiency

→ The track reconstruction efficiency for those tracks passing through this region will be reduced

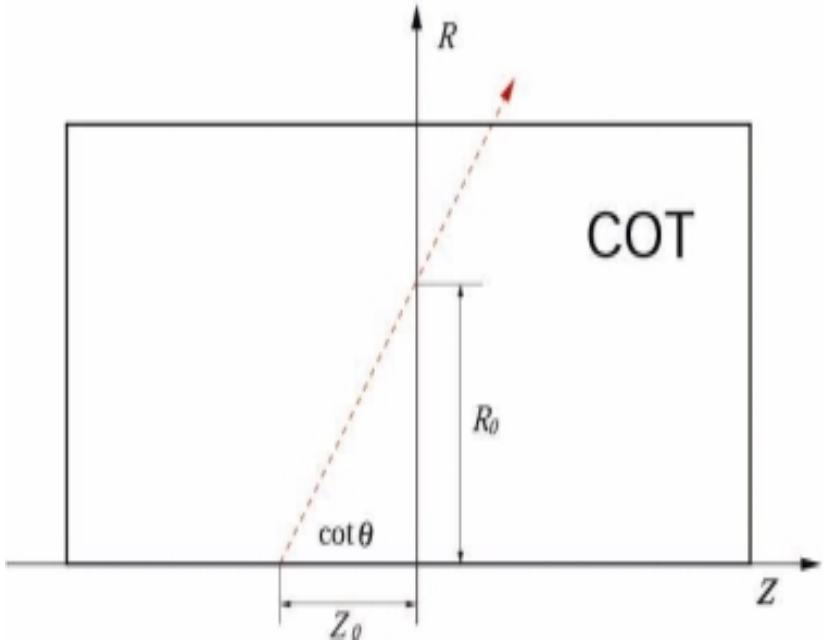
Effect of "Center Support"



A void of hits is shown near,

$z_0 \approx 0 \qquad \cot\theta \approx 0$

It means that there are no reconstructed tracks in that region.



Z is given by, $z = z_0 + R\cot\theta$

Where z is zero, $z_0 = -R_0\cot\theta$

R0 is a distance of sense wire from COT center

How to estimate lost tracks ?

offline version 4.9.1

Use jet sample(gjet08) passed JET_20_CENTRAL L3 trigger

(Run 154,769 to Run 156,116)

→ does not have trigger bias on tracks

Track Selection

Axial hits ≥ 20 stereo hits ≥ 20

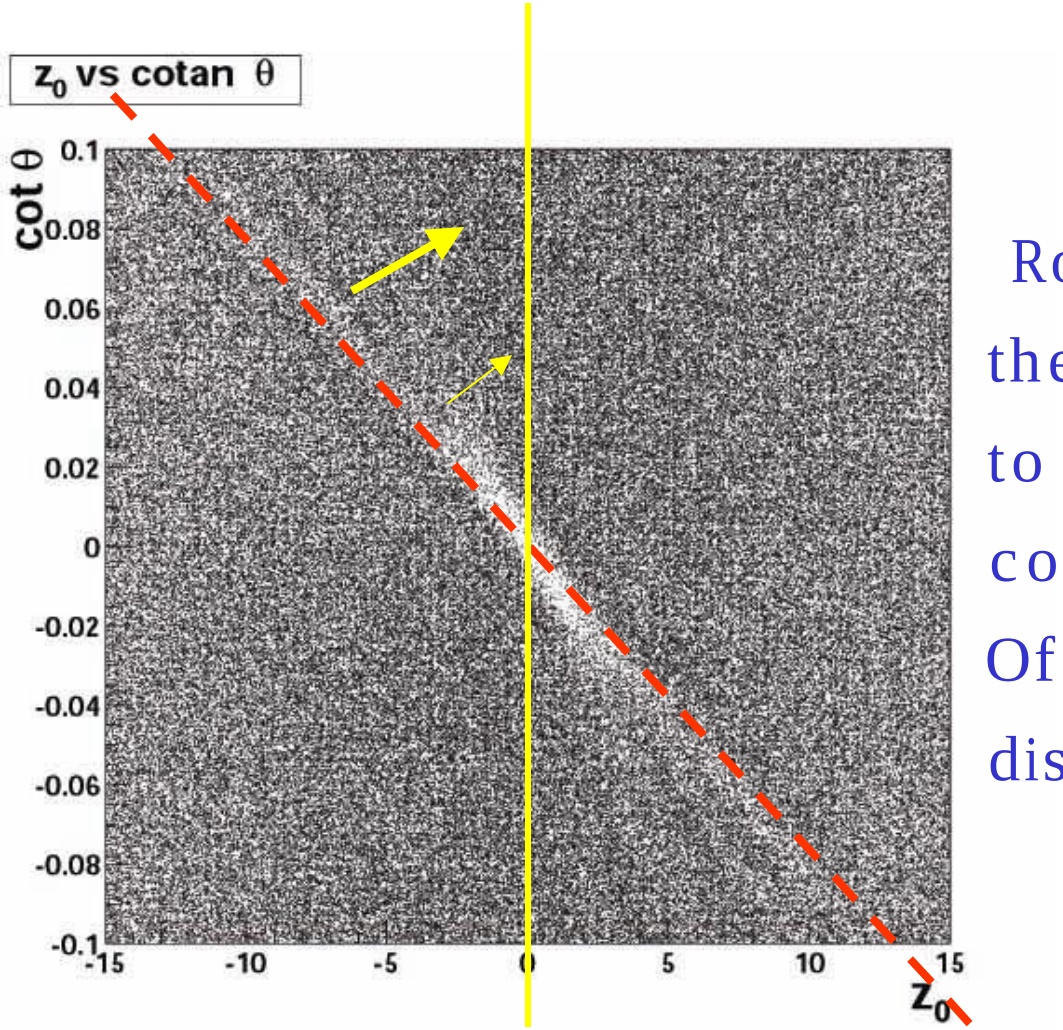
$p_T > 0.4 GeV/c$ $|d_0| < 1cm$

$|z_0| < 50cm$ $|z_0 + R_{96}\cot\theta| < 140cm$

At laeat 2 good axial SL and 2 good SL ;

good means at least 6 hists in one superlayer

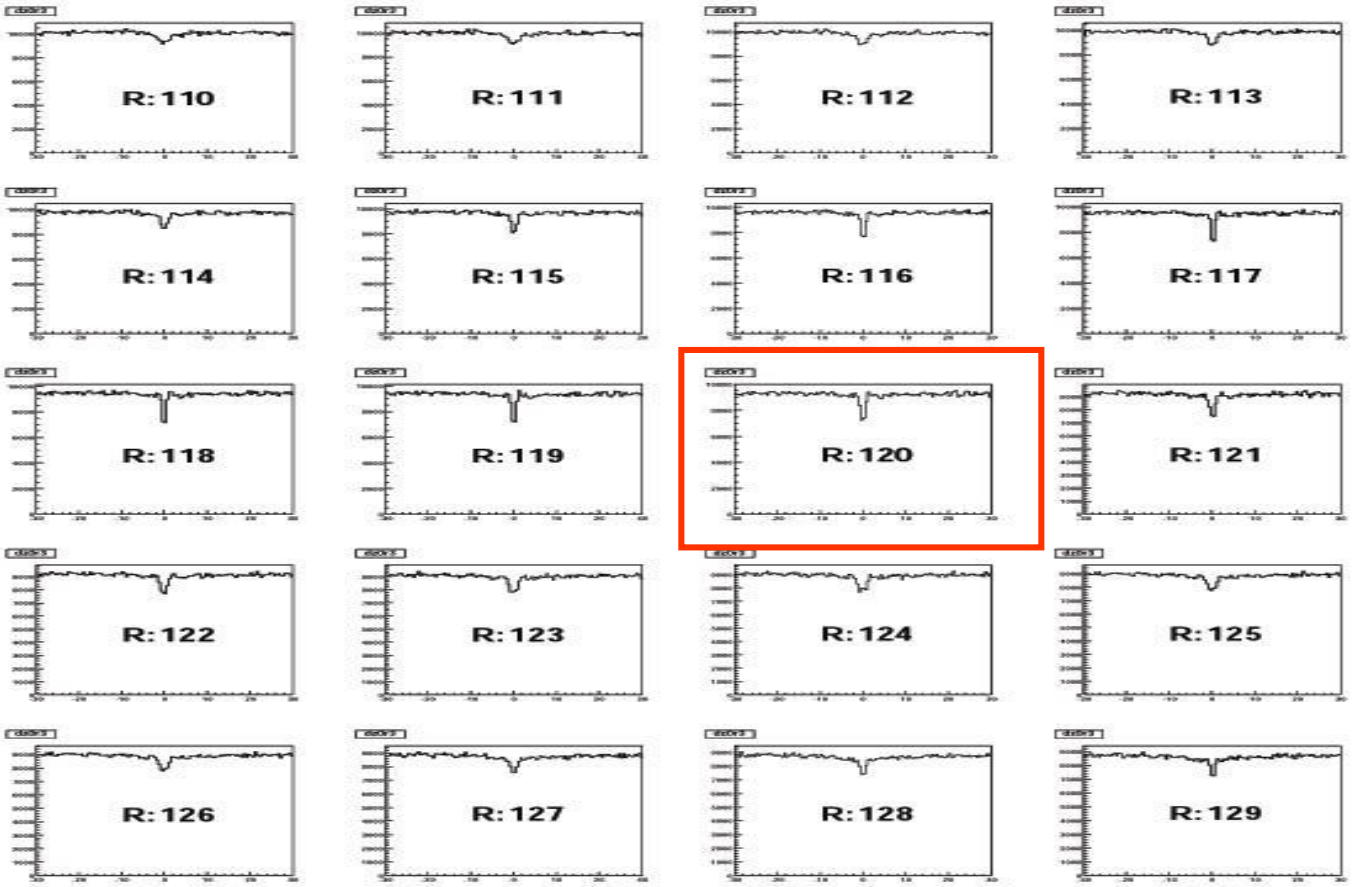
How to estimate lost tracks ?



Rotate histogram along the red axis until easy to fit

count the estimated size Of the dip on rotated z0 distribution

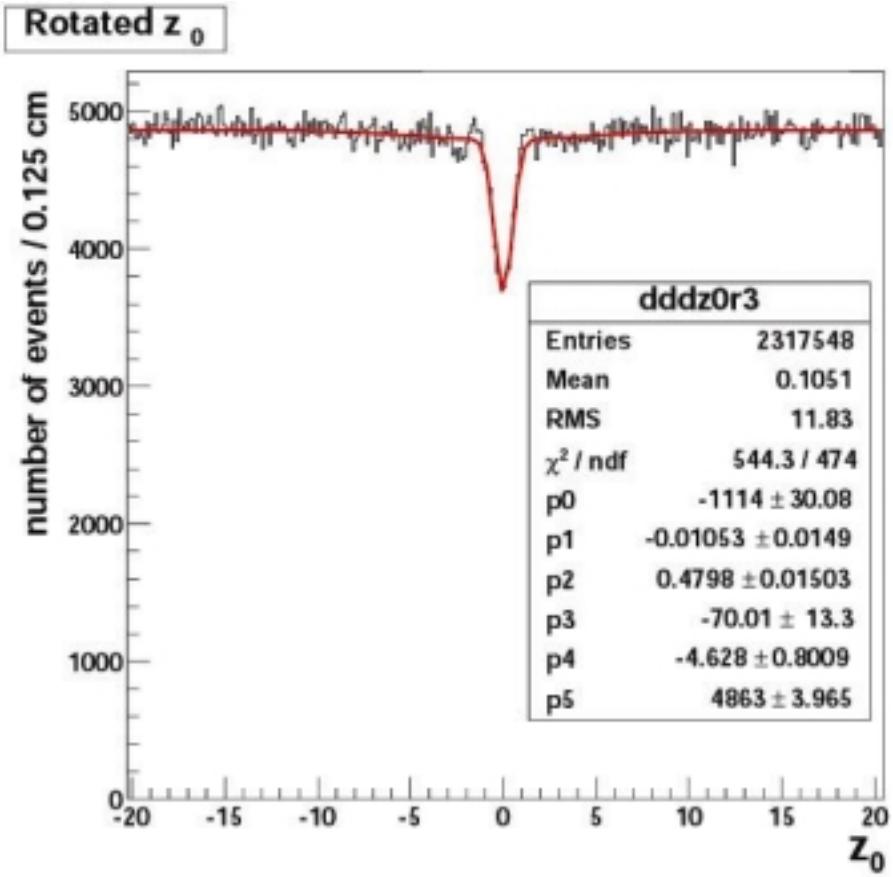
How to estimate lost tracks ?



Dip is the most significant around 120

(It corresponds the R of 83 th sense wire)

Estimation of lost tracks



Fit with 2 gaus + 0th Poly

Assume the area of 2 gaus as the lost tracks

Number of events corresponding to the size of the dip ;

17,216±1,716

Tracking Inefficiency

We define the Tracking inefficiency,

$$\varepsilon_{in} = \frac{\text{Size of dip}}{\text{Number of Total tracks}} = 0.2 \pm 0.02\%$$

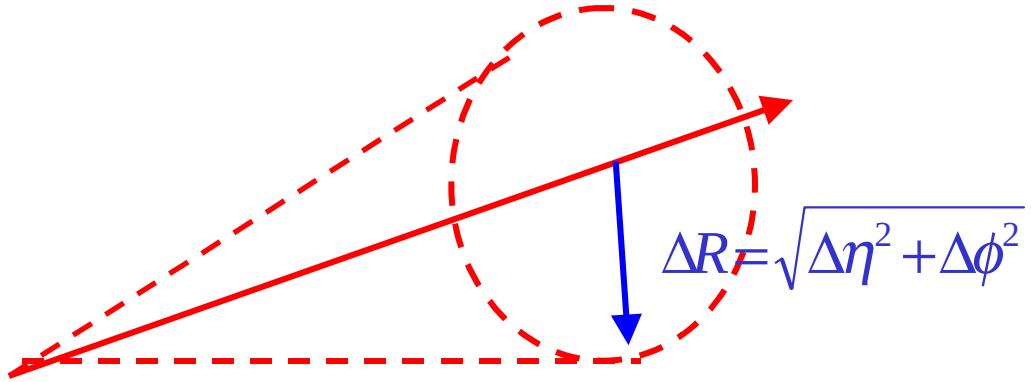
Total track ;

Number of All tracks satisfying track cuts(8,576,873)
+ Size of Dip

We get,

$$\varepsilon_{in} = 0.2 \pm 0.02\%$$

how track density affect ε_{in}



Track density ; Number of tracks inside a cone

Inefficiency increases as much as a factor of 2 at higher track density (more than 7 tracks in the cone of $\Delta R = 0.5$)

# of tracks $\Delta R = 0.5$	ε_{in}	# of tracks $\Delta R = 0.8$	ε_{in}
3	0.305 ± 0.037 %	3	0.230 ± 0.023 %
5	0.347 ± 0.051 %	5	0.244 ± 0.027 %
7	0.394 ± 0.085 %	7	0.238 ± 0.031 %

Next things...

Compare with Monte Carlo